

Practice Guideline: How to Use Biochar in Compost



The Composting Process

The composting process is governed by various physical parameters that are subject to alteration by the addition of biochar materials as bulking agents. Some of the parameters that most affect compost are: aeration, moisture content, temperature, bulk density, pH, and the absorption capacity of bulking agents. Water is held in biochar pore spaces and voids, and in the spaces between particles. Biochar increases the C:N (carbon to nitrogen) ratio of the compost. Here is a list of different impacts that biochar can have on compost:

- Biochar helps adjust the C:N of high nitrogen ingredients
- Biochar keeps compost moist and aerated
- Compost with biochar may not require turning, or may need less turning
- Biochar increases nitrogen retention
- Biochar improves compost maturity and humus content
- Biochar compost improves plant growth

We have learned that adding biochar to compost must be done with careful reference to C:N ratios. Biochar affects C:N in at least two ways: 1) biochar contains at least some degradable carbon; and 2) biochar absorbs N, making it potentially less available to compost micro-organisms. For best results using biochar in compost, it is beneficial to combine biochar directly with a high nitrogen source and then add to compost with other materials that have good C:N ratios.

When planning a compost project on the farm, it may be helpful to do some small scale experiments first to determine the correct ratio of ingredients for achieving a hot compost using biochar. Here are a few helpful things to keep in mind about biochar:

- C:N of biochar itself could be about 100:1 or greater – it depends on the biochar
- Typically, only about 10-30% of the total C in biochar is available for microbes to consume
- It is important to add enough degradable carbon (such as sugars, cellulose or carbohydrates) along with the biochar to help feed microbes
- Biochar may influence the active C:N by absorbing N
- Biochar may influence the active C:N by promoting rapid bacterial metabolism of N
- Biochar content for good compost ranges from 3%-25% depending on N content of manure, amount of degradable carbon, and other ingredients

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How to Set Up a Biochar Compost Experiment

Hypothesis

Biochar will impact compost processes (time and temperature) and compost qualities (maturity, nutrient content, humus content).

Treatments

- Set up one compost with biochar and one compost without biochar (a control treatment).
- If you like, you can replicate the experiment with multiple piles of each treatment
- Pulverize biochar to a size that is mostly ¼" or smaller. Some larger pieces are ok and will help with aeration.
- Apply biochar at between 3% and 25% by volume to the biochar compost
- Use a compost calculator (see Resources) to estimate C:N ratio of compost ingredients

Methods

- Choose a compost container – wire bins, open piles, or fiber sacks
- Construct piles in layers, taking care to add bulk materials and biochar in enough layers to allow natural aeration
- Water both piles the same
- Monitor moisture – it should pass the “squeeze test”
- The Squeeze Test – take a handful of material and squeeze. No water should come out, but when you open your hand, there should be enough moisture to hold the material together so it does not fall apart instantly

Measurements

- Use the provided data sheet for temperature measurements
- Daily temperature measurements for first two weeks (or every other day)
- Weekly temperature measurements for next 4 weeks
- Sample compost after 90 days and send for testing



Make an experimental compost using wire bins, open piles, or 100 gallon compost sacks. Measure your ingredients and mix by layering.

Lab Tests

Temperature measurements will tell you how the composting process compares with and without biochar, but to know how it compares as a fertilizer, you will want to test the results. You should expect to see an increase in retained nitrogen in the biochar compost. You may also see a difference in the indicators for compost maturity. Below are some tests you can request from most soil labs:

- Nutrient profile
- C:N ratio
- Compost stability test (CO₂ respiration)

Plant Bioassay

- Use a plant bioassay to compare soil with and without biochar compost to see what differences the compost makes in plant growth
- For instructions, see the practice guideline: *Plant Bioassays to Evaluate Biochar Compost*

Resources

Fiber Compost Sacks

Even though these only hold 100 gallons (half of a cubic yard) we found that they serve well for compost experiments. The outer edges of the sacks will be somewhat cooler, but if the C:N is right, the middle will heat up to thermophilic temperatures for good composting. You may not want to use these as your regular compost container, but they work very well for experimenting with compost ingredients and recipes. Source of fiber compost sacks:

<https://smarpots.com/compostsak/>

Compost Calculators

Several handy calculators and spreadsheets are available online to help you know the C:N of your compost ingredients and the overall C:N of the ingredients mixed together.

C:N Ratio Compost Mix Calculator

<https://www.klickitatcounty.org/1030/Compost-Mix-Calculator>

Comprehensive Composting Info

<http://compost.css.cornell.edu/science.html>

A Useful Biochar Composting Guideline

Technical Note: Conditioning Biochars for application to Soils by James Joyce BE, Principal Technologist, Black is Green Pty.

https://www.terra-char.com/uploads/2/3/7/9/23790961/composting_with_biochar.pdf

This Biochar Practice Guideline was created in 2018 by South Umpqua Rural Community Partnership.
Updates available at UBETBiochar.blogspot.com and WilsonBiochar.com.
Free to share with attribution.

Compost Pile Temperature Data Sheet

Instructions: Use one data sheet for each pile. Circle the unit you will use: F or C. Before taking pile temperature, read the thermometer dial in air and record ambient temperature. Insert thermometer as close to the center of the pile as you can. Allow at least 60 seconds for the temperature reading to stabilize. Record the temperature. If possible, take a second measurement at a different location in the pile. Make a note about the weather: clear, cloudy, rain or snow.

Units: F or C	Pile Description:			
Date/Time	Ambient Temp	pile location #1	pile location #2	Weather